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Developing an optimized breeding goal for Austrian maternal pig breeds using a participatory approach

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Abstract

Due to economic and animal welfare related issues, the Austrian pig breeding organisations revised their breeding programs. Members of breeding organisations, breeders and academic staff were involved in a participatory process from the beginning. In several meetings and workshops, 11 new fitness traits regarding maternal abilities and piglet vitality were gathered. Therefore, breeders were asked to propose important traits regarding the sow maternal ability as well as piglet vitality. Calm behaviour, milk performance and conformation were mentioned as the most important traits for the sow and suckling behaviour, high birth weight and growth rate for the piglet, respectively. Prior to routine trait recording, feasibility of trait recording was tested under practical conditions. Subsequently, breeders were trained to record the fitness traits on their farms. It has to be emphasised that farmers were highly motivated to record traits comprehensively due to their participation during the process of defining the revised breeding goals. This motivation was also reflected in good data quality.

Keywords: breeding goals, fitness traits, participatory approach, pigs

Introduction

For the last decades, breeding goals focused exclusively on prolificacy (Rutherford et al., 2013). This is also reflected in the total merit index (TMI) for Austrian maternal breeds, which consists of fertility traits (live born and weaned piglets, weight = 45% in the TMI), meat and feed efficiency traits (weight = 40% in the TMI) and functional longevity (weight = 15% in the TMI). Currently, a small genetic gain is realised for live born and weaned piglets in Austria (Draxl, 2017, personal communication). However, breeding for large litter size raises economic and ethical problems such as higher management requirements and animal welfare issues. Simultaneously, market and political requirements changed. This led to new legal regulations, e.g. to change to temporary crating or free farrowing systems in Austria by 2033. In light of these developments, Austrian Pig Breeding Organisations (APBO) recognised the need for

including traits promoting animal health and welfare into their current breeding program for maternal breeds. In cooperation with the University of Natural Resources and Life Sciences, Vienna (BOKU University) they launched a project with the aim to revise the current breeding program for maternal breeds for sows. Researchers and representatives of the breeding organisations decided to follow a participatory approach and included breeders in the process of optimizing the current breeding goals (BG). The aim of this paper is to present and discuss the intentions for and benefits of defining optimized BG in a participatory process along with its scientific outcomes. Taking a participatory approach is based on the assumption that the involvement of breeders in the definition of potential phenotypes increases their motivation to record animal welfare related traits.

Material and methods

APBO based their ideas for the revision of the BG mainly on current political and market-oriented issues. In the first phase of the project, the managing directors of APBO presented their desired BG, which mainly focussed on litter quality traits and maternal abilities, and discussed them with animal breeding and husbandry scientists. Together, they developed a concept for the revision of the BG. Additionally, the scientific partners convened a workshop with 25 participants, who consisted mainly of pig breeders and staff of APBO. In this workshop, the breeders' ideas for the revision of the BG were collected along with future requirements and potential challenges for successful pig breeding in Austria. Subsequently, all the desired fitness traits were weighted according to feasibility and costs of on-farm trait recording based on a comprehensive literature study and another revision together with other scientists in the field. The preliminary list of fitness traits was then presented to APBO and some of the pig breeders. The outcome of this second phase was a list of desired fitness traits, which comprised 18 traits. After on-farm feasibility testing of these 18 traits, 11 traits remained, which were defined in detail. Subsequently, three workshops (one in each of three participating counties) with pig breeders, piglet producers and staff of APBO (director, breeding technician, veterinarians) were organised, which consisted of two parts. For the first part, the participants (n = 56) were asked to nominate the most important traits regarding sows and piglets by answering two questions: 'How would you describe the perfect sow for your herd?' and 'How would you describe a vital piglet?' Breeders were motivated to reflect upon and substantiate the need of certain fitness traits. In the second workshop part these nominations were compared with the 11 traits to see if any further traits have to be taken into account. Furthermore, the process of trait recording, which had to be performed on-farm by the breeders, was discussed and traits were adjusted for recording if necessary. At the end of the workshop, breeders were invited to participate in the one-year trait recording period. Altogether, 24 breeders agreed and were subsequently trained to record all 11 traits on their farms. During the trait recording phase, data quality was constantly monitored and feedback was given regularly by the scientists to improve data quality and motivate breeders for this extensive data collection. After analysing the on-farm data (e.g. genetic parameters, validation of piglet vitality), several traits will be selected for modelling and comparing different scenarios of breeding programs. Suggestions for future breeding programs will be made to the APBO based on these results.

Results and discussion

Currently, the definition of BG for livestock breeding is merely based on selection index theory and their derived economic weights (Sölkner et al., 2008), whereas plant breeding is already highly client-oriented and also involves farmers in the definition of BG (Witcombe et al., 2006; Sölkner et al., 2008). The intention of introducing traits, which promote animal health and welfare aspects, into the breeding program adds a normative dimension to the current paradigm of breeding for economic efficiency. It requires addressing potentially conflicting goals such as economic profitability and improvement of animal welfare. Participatory research approaches, which aim at the involvement of stakeholders (e.g. breeders) into research processes, are often suggested as suitable methods for addressing such delicate issues (van de Fliert and Braun, 2002). Table 1 shows the traits nominated by the breeders during the first part of the workshop, ranked by number of nominations. They were almost in accordance with traits APBO and scientists discussed and defined before. Due to recording cost (e.g. appetite – requirement of exact recordings of feed intake; laying down behaviour – requires video analysis) or difficult standardization of traits recording (e.g. udder quality) several traits were discarded but discussed with breeders in the workshop. In order to meet the breeders' demands, a new conformation assessment scheme was established, which included six feet and leg traits as well as lameness and claw length. Currently, gilts are selected using only one phenotypic overall feet and leg score. Regarding desired piglet traits, only suckling behaviour was dropped. Table 2 shows the selected maternal traits around farrowing (n=8) and traits regarding litter quality (n = 3) as well as traits derived from piglets' individual birth weight (n = 3) which were recorded on-farm for a one year period. Wallenbeck et al. (2016) conducted a survey among Swedish conventional and organic pig breeders regarding desired BG. Desired BG of Austrian pig breeders were similar to Swedish organic pig breeders, who named leg health, general health and piglet survival. Similar results were observed in Denmark, were organic pig producers put more relative economic weight on traits related to maternal abilities than conventional pig producers did (Sørensen, 2015).

Trait recording for maternal ability traits and litter quality (e.g. observation of pigs, individual weighing of piglets, data input) was perceived as labour intensive by the breeders. However, involving the breeders into both, the decision making process of BG definition and the development of the data collection protocol, motivated them to record data of good quality and sufficient quantity. By end of May 2018, data of 1,800 sows and 38,000 piglets were already available. This process created a joint problem understanding and therefore motivated all involved stakeholders for finding solutions (Lang et al., 2012).The joint discussions and the participatory process of trait development created awareness for the importance of including some functional traits into a breeding program among all involved partners, including the breeders. Moreover, breeders should be encouraged to strengthen their skills and knowledge regarding breeding principles on a regular basis.

Table 1. Desired maternal and piglet traits in the breeding goal ranked by the number of nominations by participants of the workshops (n = 56, multiple answers possible, percentage is based on total number of nominations)

Maternal traits	Nominations		Piglet traits	Nominations	
	n	%		n	%
Calm behaviour	22	21.5	Suckling behaviour	13	28.3
Milk performance	19	18.4	High birth weight	11	23.9
Conformation	13	12.6	High growth rate	10	21.7
Udder quality	11	10.7	Robustness	9	19.6
Appetite	9	8.7	Agile and active	3	6.5
Farrowing behaviour	7	6.8			
Litter size	7	6.8			
Litter homogeneity	6	5.8			
Robustness	5	4.9			
Oestrus behaviour	2	1.9			
Lying down behaviour	2	1.9			
Sum of nominations	103	100		46	100

So far, participatory approaches to developing breeding goals have not been very successful in developed countries (Sölkner et al., 2008). The present project demonstrates that participatory processes in this context can lead to satisfying outcomes and it underlines the benefits of integrating scientific and practical knowledge for producing sound results for practical implementation (Schodl et al., 2015). Still, it has to be emphasised that the currently rather difficult conditions in the pig breeding sector (e.g. small number of breeders, political pressure and changing markets, strong competition) were favourable for implementing a participatory approach in this case. Nevertheless, due to the nature of traits (e.g. standardised recording, regular training of breeders, labour intensive recording) strong support from the breeding organisation is required to gain good data quality. In the next step different model calculations regarding the implementation of a piglet vitality index into routine genetic evaluation will be conducted. By means of modelling different scenarios, the effects on the genetic gain of all traits in the TMI may be evaluated. For example, the piglet vitality index could consist of average birth weight, standard deviation of birth weight and piglet vitality. Due to the fact that average birth weight, standard deviation of birth weight and piglet vitality is genetically negatively

correlated with live born piglets (Klein et al., 2018; Pfeiffer et al., 2018), appropriate weightings of all involved traits shall ensure the development of a sustainable breeding program.

Table 2. Defined and recorded traits by Austrian pig breeders

Maternal traits	Piglet traits
Recorded by breeders (assessment categories)	Recorded by breeders (assessment categories)
Manipulation of jute bags as an indirect measurement of nest building behaviour (score 1-4)	Litter uniformity (score 1-4)
Aggressiveness towards stockmen (yes/no)	Piglet vitality (score 1-4)
Aggressiveness towards piglets (yes/no)	Individual birth weight within 24 h post-partum
Calm farrowing behaviour (yes/no)	Litter weight at weaning
Birth assistance (yes/no)	Derived traits from individual birth weights:
Mastitis-metritis-agalactia (yes/no)	Average birthweight of piglets/litter
Milk performance (litter weight at birth and at weaning)	Standard deviation of individual birth weight/litter
Overall good maternal abilities (yes/no)	Percentage of piglets below 1kg in a litter

Conclusions

Although it was an ambitious endeavour to include stakeholders and breeders along the entire process, taking this participatory approach for defining BG turned out to be successful. Due to the inclusion of all the important stakeholders from the beginning, important fitness traits along with breeders' requirements were examined from various perspectives (breeders', APBO's and scientific perspectives). Moreover, the involvement of breeders in the definition of BG and the process of trait recording helped to maintain good data quality and the breeders' motivation for trait recording. Besides, training of breeders during workshops for on-farm trait recording remarkably increased their knowledge about pig breeding in general, the genetic background of fitness traits and the importance of good data quality for routine genetic evaluation.

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